The impact of intellectual capital on bank risk: Evidence from banking sectors of Bangladesh

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ABSTRACT

The main purpose of this study is to identify the impact of intellectual capital efficiency (ICE) also known as knowledge capital along with its components human capital efficiency (HCE) and structural capital efficiency (SCE) on bank risk-taking behavior in Bangladesh. To reveal this effect, the study uses generalized method of moment (GMM) estimator and Two Stages Least Square estimator (to check the Robustness) and unbalanced panel data of 32 commercial banks of Bangladesh consisting of 530 bank-year observations during the year 2003-2020. The main results of the study are: (a) ICE is significantly and positively connected with a bank’s credit risk which indicates credit risk grows up with the increase of Intellectual capital efficiency, and (b) Both the human capital efficiency and structural capital efficiency positively impacts credit risk but the impact of SCE is not significant as HCE. (c) Bank performance (ROA), RWAT, macro variable inflation, and size have a negative impact on bank risk whereas ID and GGDP insignificant positively impact on bank’s risk. Finally, the results of the study will assist the stakeholders, policymakers, and academicians for future research.

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Introduction

Firms undergo fundamental changes from labor-based business to knowledge-based business. Firms rely on knowledge to enhance their performance or commonly known as intellectual capital (IC). Moreover, Intellectual capital represents the knowledge, experience, intellectual property and information that can be put to use to create wealth (Stewart, 1997). From this definition, academics and management practitioners have given substantial attention to the role of knowledge and firm capabilities for global competitiveness and consider intellectual capital as the lever for sustaining competitive advantage and sustainable corporate performance (Mondal and Ghosh, 2012). Effective intellectual capital tends to reveal that firms utilize their intellectual capital effectively. In this respect, firms with better intellectual capital are more likely to disclose more on intellectual capital (Cahyaningrum and Atahau, 2020).

On the other hand, as financial institutions, banks collect funds from the public, especially in the form of savings, and redistribute the funds to the public through credits or other activities that enhance the public’s quality of life. There has been considerable academic and regulatory interest in how to mitigate bank risk-taking behavior and improve performance in recent years. As a services industry, banks are also recognized as an intellectual capital-intensive industry sector (Branco et al., 2011; Haris, Yao, Tariq, Javeid & Ain, 2019) which makes the recognition and development of intellectual capital an important aspect of bank management (Alhassan & Asare, 2016; Rehman, Aslam, & Iqbal, 2021). The last common strand focuses on the effect of IC efficiency on financial
performance, especially in the banking industry. Some studies confirm that banks should manage their IC as efficiently as possible because of its significant effects (Atiku, Kaïsara, Kaupa & Villet, 2022; Ozkan et al. 2017).

Intellectual capital is a complex concept where entrepreneurial and organizational aspects interact together (Paoloni, Massaro, Dal Mas, & Bagnoli, 2022). IC could have on organizational financial performance be deepened (Demartini, & Beretta, 2022). Moreover, the components of IC such as employees’ experience and knowledge, banks’ relationship with their customers, and banks’ organizational or managerial condition likely affect liquidity risk (Cahyaningrum & Atahau, 2020; Joshi, Cahill, Sidhu, & Kahil, 2013). Higher intellectual capital will reduce liquidity risk because banks that manage their intellectual capital effectively arguably manage to minimize their liquidity risk (Cahyaningrum & Atahau, 2020). Additionally, IC can also impact the capital regulations, bank’s ROA, capital regulations and Leverages (Sari and Hidayat, 2020).

Several studies have done on impact of IC on bank’s performance, on profit sharing finance, bank size, corporate performance, bank insolvency, capital efficiency, bank productivity (Cahyaningrum & Atahau, 2020; Nguyen, Le & Ho, 2021; Nazir et al., 2020; Nguyen & Nghiem, 2015; Obeidat et al. 2017). Nevertheless, very few studies attempt to investigate the impact of IC on bank risk-taking (Haris, Yao, Tariq, Malik & Javaid, 2019; Nguyen, Le & Ho, 2021; Xu, Haris & Irfan, 2022). Bangladesh is an Asian emerging economy, with impressive economic growth rates over the last two decades. The Bangladeshi government gradually implemented banking sector reforms in recent years but it is very unfortunate that there is no study on the impact of IC on Bangladeshi bank’s risk management. This study tries to fill these gaps and find out the impact of intellectual capital on risk management of banking sectors of Bangladesh.

The remainder of the paper is structured as follows. Section 2 discusses the relevant literature and development of hypotheses that underlie the paper’s analysis. Section 3 presents the data and methodology. Section 4 describes the empirical results, discussion and deals with the analysis of the robustness of those results. Finally, Section 5 concludes the paper.

**Literature review**

**Theoretical and Conceptual Background**

**Valuation of intellectual capital and element of intellectual capital**

Intellectual assets (IA) also intellectual termed as Intellectual Capital (IC) is the most significant resources of today’s organization and most of the institutions can not define what makes an IA (Andreu et al., 2007). Simply, creativeness of human brain or mind is called intellectual capital. IC is related to value and intangible nature of assets. (Edvinsson, 1997) define IC as “knowledge that can be converted into value”. Knowledge that can be converted into profit(Sullivan,2000). Non accounting researcher define “intellectual is the difference between the firm’s market value and its book value of entity” (Mouritsen, 2001, Stewart, 1997a, Sveiby, 1997). Many researchers and analyst have tried to categorize IC. At first (Sveiby, 1997) categorized IC as 3 types from non-accounting perspective namely. 1) employee (individual) competence, 2) internal structure and 3) External structure. However, (Stewart,1997b) agreed with Sveiby, but he renamed these assets as: human capital, structural capital and customer capital respectively. Again, (Bontis, 1996, Edvinsson and Sullivan, 1996) suggested for three types of IC: people’s know-how (human capital); entity’s routines, procedures, process, and databases (structural capital); and the firm’s ability to relate to markets and stakeholders (relational capital). Additionally,(Gu and Lev,2001) divided IA into five subgroups of focusing on measurement issues and the persuade of intangibles on capital market and investors. These five components are: research and development, advertising, capital expenditures, information systems and technology acquisition. The researchers of IC opined for including the human capital and structural capital as the components of IC(Andriessen, 2006, Bontis, 2004, Edvinsson, 1997). In this study we will calculate the efficiency of IC by taking into consideration of HC and SC as the parts of IC (Customer/ relational capital will also include in SC through SFA). Human capital consists of skills, knowledge and experiences of employees which can be enriched through training (Sveiby, 1997) defined HC as “the capacity to act in a wide variety of situations to create both tangible and intangible assets.” Efficient plus effective utilization of entity’s employees’ knowledge, experiences, skill, creativeness etc. ensure the proper utilization of HC and it is used to solve business problems (Mondal, 2012). Structural capital can term as supportive capital consisting of everything of a firm that assists employees and enables human capital to function properly (Mondal, 2012). Structural capital of a firm is formed with structures, systems, organizational cultures, procedures, routines, hardware and databases and it’s also included inventions, process, copyright, patents, technology, strategy(Joshi et al., 2010). Structural capital is the differences between value added and human capital (SC= VA-HC) (Pulic, 1998, Pulic, 2000, Pulic, 2004). According to Pulic (Pulic, 2000) Value Addition of current year resources is called VA which is calculated as VA= Output (total sales) – Input (cost of materials, components, and services). Pulic (2000) also proposed another way of calculating VA which is as follows:  

\[VA = OP + EC + D + A\]

\[VA = OP + (EC + D) + A\]

Moreover, (Bontis,2001) mentioned Economic Value-added (EVAe) as a comprehensive gauge for studying the achievement of whole business and proposed the following equation for calculating EVAe:  

\[EVAe = Net \ sales – operating expenses – taxes – capital charges.\]

Relational capital of a firm is termed as the relationships with all its interested groups(Choong, 2008). Again (Mondal, 2012) defines relational capital as the value of an entity’s relationships with the people in relation of whom its business.
Empirical Review and Hypothesis Development

Relationship between ICE and risk

Various researches have been conducted with unending and counterfactual conflicts whether efficiency has supremacy to risks or risk significantly impact the efficiency of banks (Altunbas et al., 2007). There is a continuous debate whether intellectual capital efficiency reduces the level of risk or not. The normal expectation between IC efficiency and risk is negative. It indicates that increased IC efficiency will help to manage risk. So, in this study we can expect a negative correlation, but different outcome also found in the past literature regarding the relationship. Several prior studies, such as, Ghosh and Maji (2014); Zheng et al., (2018); Nawaz et al. (2019); Innayah et al. (2020); Alrashidi and Alarfaj, (2020), Innayah et al., (2020) found negative association between IC efficiency. But opposite result also found in study of Guimon (2005); Nawaz et al., (2019); Sun and Chang (2011) claimed that IC could have positive effect on credit risk as they help in evaluating the organizational competitiveness and provide fine image of firm’s management team. Again Zheng et al., (2018) and they claimed that there is no significant relationship observed between risk and HCE and the capitalized banks are more capable of absorbing risk and enhancing HCE.

As the number of studies in relation to intellectual capital efficiency and bank risk taking behavior are not so high, this study also consider the relationship overall efficiency and risk.

In the study of relationship between overall efficiency and risk, Kwan and Eisenbeis (1997); Deelchand and Padgett (2009) Fiordelisi et al. (2011); and Nguyen and Nghiem (2015) among others found negative association between efficiency and risk.

Whereas, positive relationship also found in some prior studies, such as, Tan and Floor (2013); Isshaq et al. (2010).Tan and Floros,(2013) mention that risk is increased due to reducing monitoring and screening of loans but technical efficiency increases the volume of loans of bank. Isshaq et al (2010) also found positive relationship between risk and efficiency and claim that risk taking and cost efficiency of foreign banks go side by side.Again, Altunbas et al. (2007) claimed that there is no significant relationship between efficiency and risk.

These studies tried to measure the impact of a particular component of IC such as human capital or structural capital on risk but the impact of overall efficiency of IC on risk taking behavior was absent. In this study we will try to fill the gap by showing the impact of overall efficiency of IC calculated using SFA on risk taking behavior of banks. Whilst these and other such studies report a positive/ negative correlation between risk and efficiency, there is limited conclusive evidence to support a direct cause and effect relationship between overall IC efficiency and risk. From the literature it is seen that most of the studies are done on banks of developed countries. No study is done on Bangladeshi banking industry. In this paper, we focus on banks from Bangladesh by using the GMM technique and SFA.

H1: There is a significant negative relation between IC efficiency and risk of Bangladeshi banks.

H2: There is a significant negative relation between HC efficiency and risk of Bangladeshi banks.

H3: There is a significant negative relation between SC efficiency and risk of Bangladeshi banks.

Research and Methodology

Data

The study is based on secondary data on Bangladeshi commercial banks during the period 2003-2020. Data for intellectual capital, risk measures, ownership structure and performance measures would be obtained mainly from the annual reports of banks, bank’s individual website and some information from banks scope database (www.bvdinfo.com) Bloomberg and OSIRIS databases. The data for micro economic variables will be collected from the database of World Bank (http://data.worldbank.org).

After collection, data was arranged in desired layout to analyze. In this study Stochastic frontier Analysis (SFA) developed by Aigner et al., (1977) was used to measure the efficiency of intellectual capital, Human capital efficiency, structural capital of the selected banks during the study period. The study used single step Generalized Methods of Moments (GMM) apply two- stage least square (2SLS) estimator, to examine the relationship between risk taking behavior and intellectual capital efficiency. For calculation and analytical purposes the study used various statistical software packages such as Eviews 10, Frontier 4.1, and SPSS 20.
For specifying Intellectual Capital function we formulated the following:

$$\ln IC_n = f (\ln Q_i, P_i) + e_n$$

Where, $IC_n$ represents Intellectual capital of banks, $Q_i$ indicates three outputs, i.e. $Q_i =$ Total operating income, $Q_2 =$ Loan and advances, $Q_3 =$ Non interest income, $P_1 =$ Fixed assets, $P_2 =$ Personal expenses and $P_3 =$ Non performing loan. $e_n$ indicates the deviation of the actual intellectual capital of a bank from the intellectual capital-efficient frontier having two disturbance terms that are shown below:

$$e_n = V_n - U_n$$

Where, $V_n$ is random error term, and it is assumed that this is independent and identically distributed $N (0, \sigma^2_e)$. $U_n$ represents intellectual capital inefficiency and assumed to be independently distributed of $V_n$ and a half normal distribution i.e.$N (0, \sigma^2_v)$.

For specifying Intellectual Capital function we formulated the following multiproduct translog production function using intermediation approach (Sealey and Linley, 1977):

$$\ln IC_n = \alpha + \sum_i \alpha_i \ln Q_i + \sum_j \beta_i \ln P_j + \sum_k \gamma_i \ln Q_k + \sum_l \delta_i \ln P_l \ln P_j + \sum_m \lambda_i \ln Q_i \ln P_j + e$$
Based on the Jondrow et al. (1982) the expected value of \( U_n \) on conditional to
\( e_n \) shows the Intellectual capital inefficiency of bank \( n \) (termed as \( C_n \)).

\[
C_n = E[U_n/e_n] = \frac{\lambda^2 \phi(e_n \lambda/\sigma) + \epsilon_n \lambda / \sigma}{\lambda^2 + (1 + \lambda^2)}
\]

Where ratio of the standard deviation of \( U_n \) to the standard deviation of \( V_n \) is denoted as \( \lambda_n \), is the cumulative standard normal density function and \( \phi \) stands for standard normal density function. Using equation 3, \( C_n \) can be estimated. In this study, computer software named Frontier Version 4.1 developed by Coelli in 1996 has been used to obtain the efficiency using Frontier production function estimated by the method of maximum likelihood.

**Econometric model**

In this study we have developed the following three simultaneous equations by following Tan and Floros (2013); Altunbas et al. (2007); Deelchand and Padgett (2009); Fiordelisi et al. (2011) to specify the empirical model of the study:

\[
RISK_{ft} = \beta_0 + \beta_1 RISK_{ft-1} + \beta_2 IC_{ft} + \beta_3 ROA_{ft} + \beta_4 ID_{ft} + \beta_5 RWATA_{ft} + \beta_6 GGD\_F_{ft} + \epsilon_{ft}
\]

\[
RISK_{ft} = \beta_0 + \beta_1 RISK_{ft-1} + \beta_2 HCE_{ft} + \beta_3 ROA_{ft} + \beta_4 ID_{ft} + \beta_5 RWATA_{ft} + \beta_6 GGD\_F_{ft} + \epsilon_{ft}
\]

\[
RISK_{ft} = \beta_0 + \beta_1 RISK_{ft-1} + \beta_2 SCE_{ft} + \beta_3 ROA_{ft} + \beta_4 ID_{ft} + \beta_5 RWATA_{ft} + \beta_6 GGD\_F_{ft} + \epsilon_{ft}
\]

Where the \( i \) subscript denotes the cross-sectional dimension across banks, and \( t \) denotes the time dimension. The main risk measure is NPLTL ((dependent variable). Overall efficiency of IC denoted as ICE, HCE and SCE are the main independent variables in this study. ROA, ID, RWATA, SIZE, are to be used as internal control variables (independent variables) for individual bank and some macroeconomic factors INFR, GGD\_P, used as (independent variables) affecting the relationships among IC efficiency, risk. Besides the above we used twelve instrumental variable for supporting the model in regression analysis and these are NPLTL (t-1), ICE, ROA, ID, RWATA, SIZE, LEV, GOVS, INF and constant.

Equation (1) examines whether level of risk is affected by the changes in IC efficiency, whereas equation (2) examines how risk is affected with the changes in HCE efficiency, 3) examines whether level of risk is affected by the changes in SCE efficiency during the study period.

**Table 3: Correlation matrix**

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
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<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
</tr>
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<tbody>
<tr>
<td>NPLTL</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICE</td>
<td>.418*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCE</td>
<td>.502**</td>
<td>.634**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCE</td>
<td>.158**</td>
<td>-.060</td>
<td>.127**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROA</td>
<td>-.379**</td>
<td>-.253**</td>
<td>-.273**</td>
<td>.166**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td>.422**</td>
<td>.209**</td>
<td>.220**</td>
<td>-.018</td>
<td>-.194**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RWATA</td>
<td>-.498**</td>
<td>-.169**</td>
<td>-.341**</td>
<td>-.326**</td>
<td>.218**</td>
<td>-.151**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIZE</td>
<td>.077</td>
<td>.370**</td>
<td>.286**</td>
<td>-.720**</td>
<td>-.306**</td>
<td>.166**</td>
<td>.241**</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GGD_F</td>
<td>-.210**</td>
<td>.063</td>
<td>.093**</td>
<td>-.579**</td>
<td>-.189**</td>
<td>-.073</td>
<td>.224**</td>
<td>.513**</td>
<td>.169**</td>
<td>-.115**</td>
<td>.206**</td>
<td>.215**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>IFR</td>
<td>-.304**</td>
<td>.091**</td>
<td>-.094**</td>
<td>-.272**</td>
<td>-.004</td>
<td>.077</td>
<td>.502**</td>
<td>.443**</td>
<td>.140**</td>
<td>-.153**</td>
<td>.578**</td>
<td>.140**</td>
<td>.339**</td>
<td>1</td>
</tr>
</tbody>
</table>

**Source:** Author’s calculation by using SPSS 20

**Note:** The table represents the Pearson’s correlation matrix for the variables used in this paper. The dependent variable in regression model is Non Performing Loan (NPLTL) The primary explanatory variables are Intellectual Capital Efficiency (ICE), Human Capital Efficiency (HCE) and Structural Capital Efficiency (SCE). Where ROA, ID, RWATA, SIZE, Growth of Gross Domestic Product (GGD\_P) and Inflation (IFR) are used as independent variable. Beside these above CAP, LEV, GOVS, NPLTL (t-1) are used as instrumental variables along with all independent variables.

**Empirical Results and Discussions**

**Result of GMM Approach**

The Lagrange Multiplier Test (LM test) rejects the null hypothesis. Errors can be identified in variables that are peculiar to a bank. The cross-sectional heteroskedasticity of the investigation was assessed using the white test (White, 1980). The null hypothesis of the homoskedasticity test was rejected (at a 5% significant level) (White, 1980). As a result, the findings of this study are not supported by the ordinary least squares (OLS) method. As a result, we use a generalized method of moments (GMM) estimator to deal with this outcome.
For the probability original model implementation, the GMM estimate uses instrumental variables established by Hansen (1982). The 2SLS estimator is less efficient than the GMM estimator, according to them (Hall, 2005), but it allows for heteroskedasticity. The main findings of this investigation are summarized in Table 4.

### Table 4: Effects of IC Efficiency, HCE, SCE on credit risks

<table>
<thead>
<tr>
<th>Variables</th>
<th>Dependent Variable- NPLTL</th>
<th>Model-1</th>
<th></th>
<th></th>
<th>Dependent Variable- NPLTL</th>
<th>Model-2</th>
<th></th>
<th></th>
<th>Dependent Variable- NPLTL</th>
<th>Model-3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Std. Error</td>
<td>t-Statistic</td>
<td>Coefficient</td>
<td>Std. Error</td>
<td>t-Statistic</td>
<td>Coefficient</td>
<td>Std. Error</td>
<td>t-Statistic</td>
<td></td>
</tr>
<tr>
<td>NPLTL (ln)</td>
<td>0.559***</td>
<td>0.127</td>
<td>4.400</td>
<td>0.521***</td>
<td>0.061</td>
<td>8.751</td>
<td>0.552***</td>
<td>0.097</td>
<td>5.743</td>
<td></td>
</tr>
<tr>
<td>ICE</td>
<td>0.210**</td>
<td>0.087</td>
<td>2.411</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCE</td>
<td>0.034**</td>
<td>0.013</td>
<td>2.361</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCE</td>
<td>0.012***</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.034**</td>
<td>0.000</td>
<td>-3.000</td>
<td>0.009*</td>
<td>0.003</td>
<td>-2.370</td>
<td></td>
</tr>
<tr>
<td>ROA</td>
<td>0.057***</td>
<td>0.014</td>
<td>3.817</td>
<td>0.051***</td>
<td>0.014</td>
<td>4.552</td>
<td>0.053***</td>
<td>0.013</td>
<td>3.690</td>
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<tr>
<td>ID</td>
<td>-0.052**</td>
<td>0.020</td>
<td>-2.570</td>
<td>-0.061***</td>
<td>0.021</td>
<td>-2.971</td>
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<td>0.021</td>
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<td>RWATA</td>
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<td>-0.482</td>
<td>-0.000*</td>
<td>0.000</td>
<td>1.903</td>
<td>0.011*</td>
<td>0.006</td>
<td>1.703</td>
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<tr>
<td>SIZE</td>
<td>0.018</td>
<td>0.037</td>
<td>0.481</td>
<td>-0.012*</td>
<td>0.000</td>
<td>-1.671</td>
<td>0.054</td>
<td>0.037</td>
<td>0.141</td>
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<tr>
<td>GGDP</td>
<td>-0.005</td>
<td>0.002</td>
<td>-1.980</td>
<td>0.000*</td>
<td>0.000</td>
<td>-1.671</td>
<td>0.055</td>
<td>0.004</td>
<td>-1.260</td>
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<td>IFR</td>
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<td>0.102</td>
<td>-1.202</td>
<td>0.042</td>
<td>0.041</td>
<td>1.011</td>
<td>0.139</td>
<td>0.250</td>
<td>-0.551</td>
<td></td>
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<tr>
<td>R-squared</td>
<td>0.617</td>
<td>0.671</td>
<td>0.668</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Adjusted R- squared</td>
<td>0.612</td>
<td>0.662</td>
<td>0.654</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>S.E. of regression</td>
<td>0.051</td>
<td>0.042</td>
<td>0.041</td>
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### Notes
- The table shows the empirical results of GMM Panel estimator. Non-Performing Loan to Total Loan (NPLTL) is the dependent variable. This study uses two factors, ID and RWATA, to control bank-specific heterogeneity. Sargan test(s) for over-identifying restrictions. AR (1) and AR (2) = first and second order autocorrelation. ***, ** and * indicate the significance level at 1%, 5% and 10% respectively.

### Source
Authors calculation through Eviews-10

When the independent variable IC efficiency, HCE and SCE are taken into account, Model 1, Model-2 and Model-3 are used respectively. The lag value of a dependent variable is positive (Model-1, Model-2, and Model-3), it means that the preceding year had an impact on credit risk.

Credit risk (NPLTL) is positively and significantly connected to ICE (SFA) according to the findings (Model-1), implying that a 1% rise in ICE raises credit risk by 0.210 percent. According to Hypothesis 1, there is a significant negative relationship between IC efficiency and Bangladeshi bank risk. As a result, the results of this study (Model-1) did not back up hypothesis 1, the findings inverse to (Zheng et al., 2018). When HCE (SCE) is used as an independent variable rather than ICE, these Models (Model-2, Model-3) indicate a positive and substantial relationship between credit risk and HCE and SCE. They (HCE and SCE) show that a 1% increase in HCE (SCE) raises credit risk by 0.034 percent (0.080 percent). Model-2 and Model-3 findings are comparable to model-1. Hypotheses 2 and 3 show that there is a significant negative relationship between HC efficiency (SC efficiency) and Bangladeshi banks risk. As a result, the findings of this study (Models 2 and 3) did not corroborate hypotheses 2 and 3. Unfortunately, Model-3 shows an insignificant relationship between SCE and NPLTA. According to the findings, Improved IC efficiency will increase credit risk, which will eventually diminish financial stability in this country. Consequently, special care should be taken to increase the efficiency of banks' intellectual capital in underdeveloped countries (such as Bangladesh).

Model-1 and Model-2 (Model-3) are negatively (positively) connected with credit risk-taking in terms of performance, which indicates that a 1% rise (reduction) in bank performance ROA would result in credit risk lowering (raising) by 0.013 percent, 0.012 percent, (0.009 percent) respectively. Income diversification (ID) and risk weighted assets to total assets (RWATA) are both positively
(negatively) related to credit risk-taking, meaning that a 1% increase (decrease) in ID (RWATA) would result in credit risk rising (lowering) by 0.057 percent, 0.051 percent, 0.054 percent (0.052 percent, 0.061 percent, 0.050 percent, respectively). The remaining variables are summarized as follows: Models 2 and 3 demonstrate a positive association between NPLTL and bank size, but Model 1 shows a negative and insignificant relationship. Model-1 and Model-3 demonstrate a favorable (insignificant) association between NPLTL and GGDP, whereas Model-2, sadly, reveals a negative relationship. Models 2 and 3 demonstrate that NPLTL and inflation rate have a positive association, but Model 1 shows that NPLTL and inflation rate have a negative (insignificant) relationship.

This study will mainly contribute in two aspects: firstly, from the managerial approach the concept of measuring IC performance is new, this study applies SFA to examine the performance of IC to assist in examining the relationship it with risk taking behavior. The academia would be complemented through the joint analysis of SFA and GMM model. This study will show how to use these two models jointly to come up with the determinants of efficiency. This study will contribute to the development of intellectual capital theory as well as the agency theory, stakeholders’ theory. The results of the study will be useful for bank management, policy maker, and regulator and academia for future research.

Robustness check and analysis

Following Joher et al., (2006); Ori et al., (2010); Matejasak and Cemohorsky, (2009). 2SLS is used to attain the robustness findings in Table 5.

| Table 5: Effects of IC Efficiency, HCE, SCE on credit risks |
|---------------------------------|----------------|----------------|----------------|
|                                  | Model-1       | Model-2       | Model-3       |
| Variables                        | Coefficient   | Std. Error    | t-Statistic    | Coefficient   | Std. Error    | t-Statistic    | Coefficient   | Std. Error    | t-Statistic    |
| NPLTL (t-1)                      | 0.577***      | 0.106         | 5.440          | 0.561***      | 0.111         | 5.103          | 0.572***      | 0.119         | 5.451          |
| ICE                              | 0.214***      | 0.081         | 2.641          |               |               |                |               |               |                |
| HCE                              |               |               |                | 0.051*        | 0.036         | 1.608          |               |               |                |
| ROA                              | -0.013***     | 0.006         | -2.164         | -0.011*       | 0.001         | -1.634         | -0.012*       | 0.003         | -1.762         |
| ID                               | 0.060***      | 0.018         | 3.363          | 0.061***      | 0.024         | 3.203          | 0.062***      | 0.021         | 3.141          |
| RWATA                            | -0.058***     | 0.023         | -2.421         | -0.063***     | 0.022         | -2.551         | -0.061*       | 0.021         | -2.710         |
| SIZE                             | -0.009        | 0.014         | -0.678         | -0.013        | 0.021         | -0.278         | 0.013         | 0.014         | 1.471          |
| GGDP                             | 0.024         | 0.033         | 0.738          | 0.021         | 0.040         | 0.401          | 0.029         | 0.053         | 0.391          |
| IFR                              | -0.006**      | 0.003         | -2.099         | 0.008*        | 0.000         | -1.711         | -0.012        | 0.015         | -1.521         |
| C                                | -0.141***     | 0.097         | -1.446         | 0.012         | 0.081         | 0.115          | -0.231        | 0.312         | -0.740         |
| R-squared                        | 0.587         | 0.631         | 0.637          |               |               |                |               |               |                |
| Adj. R-sq.                       | 0.581         | 0.634         | 0.632          |               |               |                |               |               |                |
| S.E. of regr. (p-value)          | 0.053         | 0.052         | 0.051          |               |               |                |               |               |                |
| Sargan test                      | 0.813 (0.214) | 3.814 (0.245) | 2.443 (0.192) |               |               |                |               |               |                |
| Probit (p-value)                 | 0.846         | 0.281         | 0.491          |               |               |                |               |               |                |
| LM Test (p-value)                | 0.000         | 0.000         | 0.000          |               |               |                |               |               |                |
| AR (1) (P-value)                 | 0.000         | 0.001         | 0.000          |               |               |                |               |               |                |
| AR (2) (P-value)                 | 0.329         | 0.251         | 0.372          |               |               |                |               |               |                |
| No. of observations             | 530           | 530           | 530            |               |               |                |               |               |                |
| Instrument rank                  | 12            | 12            | 12             |               |               |                |               |               |                |

Source: Authors calculation through Eviews-10

Notes: The table shows the empirical results of Two stages Least Square Panel estimator (2SLS). Non-Performing Loan to Total Loan (NPLTL) is the dependent variable. This study uses two factors, ID and RWATA, to control bank-specific heterogeneity. Sargan test= for over-identifying restrictions. AR (1) and AR (2) = first and second order auto correlation. ***, ** and * indicate the significance level at 1%, 5% and 10% respectively.

With the exception of a few examples, the most of the findings are identical to the primary results: When the primary findings demonstrate a favorable influence on credit risks, the ROA in Model-3 reveals a negative effect on them. When the primary findings reveal a positive (negative) effect between them, bank size and (GGDP) in Model-2 have a negative (positive) effect on credit risks. When the major findings demonstrate a positive relationship between them, the inflation rate in Model-3 has a negative effect on credit risks.

Conclusions

This study attempts to measure the impact of intellectual capital efficiency on bank risk taking behavior of selected commercial banks in Bangladesh. The study found that ICE and its component HCE significant positively impact on bank’s credit risk although other component SCE has positive but insignificant impact on risk. The result of the study is very much important for the bank management...
to think about the investment in IC, as it indicates that there is an increase of bank’s risk with the increase in investment IC. The result of the study agreed with the study Zheng et al., (2018) and disagreed with the study of Alrashidi and Alarfaj, (2020). The results of the study slightly nuance with resource-based theory that state that firms’ strategic valuable resources help in improving effectiveness and neutralize the threats Barney (1991). In this study ICE positively impacts on banks risk that indicates that increase in investment of IC a valuable strategic resource leads to increase banks’ risk. The strength of the study is that the Bangladeshi Banking industry is trying to invest more in intellectual capital such as private commercial banks that encourages the researcher to have study in relation to risk and intellectual capital along with other bank level and macro level variables. However, the major limitation of this study is that it is conducted only in the context of Bangladeshi banking industry and it did not cover all banks of Bangladesh. A cross country analysis would be more authentic in supporting the result. The study recommends that management of banks should endeavor to invest more on IC in order to enhance the banks performance and minimizing risk level. Future studies could be done in the context of multiple countries to show the impact of ICE along with corporate governance both on bank’s credit risk and solvency risk.

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Conflicts of Interest: The authors declare no conflict of interest.

References


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